THE INSTITUTE OF PHYSICS
47 BELGRAVE SQUARE, LONDON, S.W.1.

BULLETIN

No. 52 APRIL, 1954

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The Bulletin is not intended for general circulation : your copy should not therefore be passed to a library.

APPOINTMENTS VACANT

The inclusion of particulars of a vacancy must not be taken to imply that the Institute necessarily approves of the terms offered or that might be offered. Candidates should satisfy themselves that these are satisfactory, and they may always refer to the Institute for advice.

ROYAL TECHNICAL COLLEGE, SALFORD
Principal :
P. F. R. Venables, B.Sc., Ph.D., F.R.I.C.

Department of Pure and Applied Physics

A short Post-Graduate course on Semiconductors will be held on Friday, May 21, and Saturday, May 22, 1954.

Lecturers :
Professor F. A. Vick, O.B.E., Ph.D., F.Inst.P.
H. J. Clark, B.A.
J. A. F. Cormick, B.A., A.Inst.P.
W. Needham, M.Sc., M.I.E.E., F.Inst.P.
H. V. Shurmer, M.Sc., Ph.D.
D. D. Jones, M.Sc., D.I.C.
D. A. Wright, M.Sc., F.R.A.S., F.Inst.P.

Fee for the course is £1 10s. 6d.

Forms of application giving brief details of the lectures, may be obtained from the Head of Department, W. G. Darvell, M.Sc., F.Inst.P., Royal Technical College, Salford.

H. H. TOMSON,
Clerk to the Governors.

Ministry of Supply invites applications for a limited number of **senior and junior Fellowships** tenable for three years at the **Radar Research Establishment, Malvern, Worcs.,** commencing in Autumn, 1954. Candidates must be British subjects with either a first or second class honours degree in an appropriate subject and must be able to show evidence of a very high standard of ability in research. Fellows will be allowed considerable choice of subjects within the fields of interest to the Establishment. These include experimental and theoretical research in low temperature physics, electrical and optical properties of semi-conductors, infra-red spectroscopy, microwave physics, and electronics. For junior Fellowships candidates should have had at least two years' post-graduate research experience and should preferably be aged 23 to 26 ; candidates for senior Fellowships should have had at least three years' post-graduate research experience and should preferably be aged 26 to 30. Remuneration will depend on individual merit and will be between £800–£1,000 per annum for senior Fellows and £500–£700 per annum for junior Fellows, both carrying benefits under F.S.S.U. At the expiry of a Fellowship a holder may be considered for an established post at the Establishment if he so desires.

Application forms are obtainable from the Director, Radar Research Establishment, Malvern, Worcs., to whom they must be returned by April 30, 1954, together with suitable testimonials regarding research ability, and, where possible, copies of candidates' published papers.

Physicist required by the **British Iron and Steel Research Association** in the Fluid Dynamics Section of the physics department in London. Candidates should have a degree in physics and should be capable of applying experimental techniques to the solution of fluid problems in the Iron and Steel Industry. Starting salary £550 – £700 p.a. according to age, qualifications and experience. Post is superannuated under the F.S.S.U. Written applications only to Personnel Officer, British Iron and Steel Research Association, 11 Park Lane, London, W.1.

British Electricity Authority, Research Laboratories, Leatherhead, require a junior engineer for testing, development and research work in the laboratories and in the field, in connection with the generation of electricity. Candidates should have a Higher National Certificate or equivalent qualifications in electrical or mechanical engineering or in physics. Salary N.J.B. Grade 6, £390 – £606.

Forms from D. Moffat, Director of Establishments, British Electricity Authority, Winslay Street, London, W.1, to be returned by April 13, 1954. Quote reference BIP/461.

The joint research organization of **Richard Thomas and Baldwins Ltd.,** and **The Steel Company of Wales Ltd.,** invite applications for the following appointments in the Physics Department :—(*a*) **Senior research physicists,** with experience in the principles and application of physical techniques to metallurgical research. Good honours degree essential ; (*b*) **Assistant research physicists** with experience in the principles and application of physical techniques to metallurgical research. Good honours degree essential.

Replies, stating salary required, should be addressed in the first instance, to the Director of Research, RTSC Laboratories, Whitchurch, Nr. Aylesbury, Bucks.

Technical College of Monmouthshire, Crumlin. A Laboratory Technician to take up duties on May 1, 1954, or as soon as possible after that date, is required at the above college.

Candidates must have had experience as a Laboratory Assistant or Steward and should have a good practical knowledge of one or more of the following crafts, viz. :—scientific glass-blowing, carpentry, photographic processing, instrument or apparatus repair or preparation of metallurgical specimens.

Candidates should hold an appropriate Ordinary National Certificate or City & Guilds Certificate. Salary £400 × £20 × £15 × £15 to £450 per annum.

Forms of application obtainable from C. E. Gittins, Director of Education, County Hall, Newport, Monmouthshire, to be returned not later than April 16, 1954.

University of Reading. Applications are invited for the post of **research assistant** in the Physics Department to work on problems connected with diffusion in solids. Candidates should possess an honours degree in physics, and previous experience in solid state physics is desirable. Salary according to qualifications and experience. Applications, together with the names of two referees should be sent to the Professor of Physics, Physics Research Laboratories, 78 Upper Redlands Road, Reading, Berks.

Instrument development. **Mechanical engineer** or **physicist** required to develop industrial and laboratory instruments. Degree or similar qualifications and a few years experience of development work required. Write giving full details and salary required to Nash and Thompson Limited, Oakcroft Road, Tolworth, Surrey.

(*Continued on page iii*)

THE INSTITUTE OF PHYSICS

No. 52 **BULLETIN** April, 1954

THIRTY-FOURTH ANNUAL GENERAL MEETING

NOTICE IS HEREBY GIVEN that the Thirty-Fourth Annual General Meeting of The Institute of Physics will be held at 5 p.m. on Tuesday, May 18, 1954, in the Institute's House, 47 Belgrave Square, London, S.W.1. Attendance is limited to Fellows and Associates of the Institute. The business to be conducted is the consideration of the Board's report, the accounts and balance sheets for 1953, the declaration of the election of the Honorary Officers and other members of the Board nominated, and the election of auditors. A copy of the annual report and accounts is printed in this issue of the *Bulletin*. Further copies will be sent on request.

AND NOTICE IS HEREBY FURTHER GIVEN that the following Resolutions will be submitted to the meeting as Special Business for consideration and if thought fit passing with or without modification, that is to say :—

Resolution 1. That in By-law 21(*c*) the words " one guinea " be substituted for the words " one-and-a-half guineas."

Resolution 2. That in By-law 24 the words " one guinea " be substituted for the words " one-and-a-half guineas."

B. P. Dudding,
Honorary Secretary.

April 9, 1954.

REVISION OF BY-LAWS 21 (c) AND 24

In support of the Resolutions revising the above By-laws the Board makes the following remarks :

By-law 21(*c*) relates to the fees payable by Graduates and By-law 24 to those payable by Subscribers. The amendments concern only the few Graduates and Subscribers permanently resident abroad.

In 1950 soon after the subscription rates and the special rates for which Graduates and Subscribers could receive the Journals were revised some anomalies in the scales relating to the fees of overseas Graduates and Subscribers were pointed out. The Board then exercised the powers conferred on it by By-law 19 to reduce the fees of the few members then concerned in order to remove the anomalies.

As the number of overseas members affected continues to grow the Board desires to amend the By-laws to regularize the position.

B. P. DUDDING,
Honorary Secretary.

April 9, 1954.

THE INSTITUTE'S FINANCE

For the purpose of the official published accounts the Institute's work is divided into " professional," and scientific and educational work, the latter two forming the activities of the Endowment Trust Fund—a charity administered by the Board of the Institute. But for the convenience of members who may wish to have a simple general picture of the Institute's financial affairs as a whole, the Board has, as last year, ordered that a consolidated income and expenditure account and balance sheet shall be published in the *Bulletin*.

The Benevolent Fund capital is shown on the consolidated balance sheet to give a complete picture of the Institute's financial responsibilities but its income and expenditure has not been included in the consolidated account as the money cannot be used for the Institute's normal work.

The surplus on the year's working is £3,763 and after deductions have been made from this for depreciation and the other items shown (including £985 as premium on the Leasehold Redemption Policy which is, of course, a form of capital), there is a final net surplus for the year of £490. The corresponding budgeted estimates made in November, 1952, were £3,600 and £1,900 respectively (see page 12 of the February, 1953, *Bulletin*). Once again the money received from the sales of books has been applied to the reduction of the " book value " of the stocks until the cost of printing and producing them has been recovered. This prudent action accounts for the stock depreciation reserve item of £1,566.

The cost of Journals supplied to Members (without charge additional to their membership fees) is somewhat less than the previous year although the number of copies supplied has increased ; the reason for this is principally a slight reduction in the cost of paper.

It will be seen from the consolidated balance sheet that the Institute's financial position is sound and that its reserves are once again gradually being built up. Nevertheless the Board does not consider that it is yet able to enter into important new financial commitments.

THE INSTITUTE OF PHYSICS

Consolidated Balance Sheet, 31st December, 1953

1952		£	£
£			
5,053	Life Membership Fund ...		5,000
8,764	Reserve Fund		13,089
71	Furnishing Fund		208
6,631	Endowment Trust Fund ...		3,834
3,762	Benevolent Fund		4,170
	CURRENT LIABILITIES :		
	Subscriptions to 1954 Journals and payments from members in advance	8,239	
11,267	For expenses including production of publications ...	5,103	
3,718	X-ray Index Fund	7,553	
5,112	Bowen Prize Fund	3	
50			20,898
£44,428			£47,199

1952		£	£
£			
	FIXED ASSETS :		
	Furniture, Fittings and Office Equipment at cost... ...	4,592	
	Less depreciation	2,708	
1,898			1,884
	Alteration, Improvements and Adaptation of Premises at cost	10,290	
	Less depreciation ...	3,106	
7,562			7,184
	CURRENT ASSETS :		
	Stock on Hand ...£8,807		
	Less Book Stock depreciation reserve 2,219		
6,905		6,588	
8,023	Debtors	5,011	
242	Subscriptions in arrears ...	48	
6,480	Investments at cost ... ... (mean market value : £11,794)	12,099	
2,955	Leasehold Redemption Policy	3,940	
10,363	Bank Balances and Cash in Hand	10,445	
			38,131
£44,428			£47,199

Consolidated Income and Expenditure Account

1952 £		1953 £
	To Office and General Expenses :—	
10,920	Salaries and National Insurance and Staff Superannuation	12,766
2,665	Rent, Rates, Lighting, Cleaning and Maintenance	3,862
940	Postage and Telephone	1,161
636	Travelling Expenses, Board and Committee meetings	782
16,894	„ Production and Distribution of Publications (excluding cost of office labour and overheads) ...	17,425
1,716	„ Miscellaneous Office Expenses, Printing and Stationery	1,872
126	„ Bulletin (net)	359
1,608	„ Branches and Groups (including Australia) ...	1,793
2,689	„ Conferences and Conventions	873
209	„ Educational work, Examinations (net) and Special reports	148
624	„ Miscellaneous expenses and House vote	481
39,027		41,522
1,814	„ Copies of Journals supplied to Members	1,646
5,795	„ Surplus for the year before deduction for depreciation, etc.	3,763
£46,636		£46,931

	To Amount written off expenditure on alterations, etc.,	
515	to House	378
320	„ Depreciation of Furniture and Fittings	344
985	„ Leasehold Redemption Policy Premium	985
653	„ Books, Stock depreciation reserve	1,566
3,322	„ Final surplus for the year	490
£5,795		£3,763

for the year ended 31st December, 1953

1952		1953
£		£
20,595	By Receipts from Publications	24,598
5,516	„ Receipts from Advertisements in Journals ...	7,018
10,921	„ Member's subscriptions, entrance and application fees	11,509
201	„ Dividends and Interest	200
164	„ Donations received by Trust Fund	184
3,563	„ Glasgow Conference Income	—
500	„ Scientific Publications Grant (per Royal Society) ...	300
41,460		43,809
1,814	„ Copies of Journals supplied to Members	1,646
3,362	„ Increase in Stock of Publications	1,476
£46,636		£46,931
5,795	By Surplus brought down	3,763
£5,795		£3,763

NOTICES TO MEMBERS

Nominations to the Board

Fellows and Associates will have received formal notification of the Board's nominations to fill vacancies on the Board which will occur on September 30 next. These are :

President : Sir John Cockcroft, K.C.B., C.B.E., F.Inst.P., F.R.S., Nobel Laureate. Director, Atomic Energy Research Establishment, Harwell ; Chairman, Defence Research Policy Committee.

Vice-President : (one vacancy) G. R. Noakes, M.A., F.Inst.P. Assistant Master, Uppingham School.

Hon. Treasurer : *S. Whitehead, M.A., D.Sc., M.I.E.E., F.Inst.P., Director, British Electrical and Allied Industries Research Association, Greenford, Middlesex.

Hon. Secretary : *B. P. Dudding, M.B.E., A.R.C.S., Ph.D., F.S.G.T., F.Inst.P., Vice-Chairman, Scientific Advisory Panel and Research Physicist, Research Laboratories, The General Electric Co. Ltd., Wembley.

Ordinary members of the Board : (two vacancies) K. A. G. Mendelssohn, M.A., F.Inst.P., F.R.S. University Demonstrator in Physics, Clarendon Laboratory, Oxford.

H. P. Rooksby, B.Sc., F.Inst.P. Leader of Crystal Analysis and Radiology Group, Research Laboratories of The General Electric Co. Ltd., Wembley.

* *For re-election to the same office.*

Elections to the Royal Society

Members will be pleased to learn that the following members of the Institute have recently been elected to Fellowship of the Royal Society :— Professor E. G. Cox (Fellow), Dr. J. L. Pawsey (Fellow), Professor R. D. Preston (Fellow), Dr. M. F. Perutz (Subscriber).

Presentation of Gift to the Institute

At the Board meeting held on March 16 Mr. O. W. Humphreys (Vice-President) on behalf of the Research Laboratories of The General Electric Co. Ltd., of which he is Director, presented to the Institute the set of tables which have been specially made for the Board Room.

Mr. O. W. Humphreys (left) formally presenting the tables to the President, Dr. Sykes ; the Honorary Treasurer, Dr. S. Whitehead, is seated on the right.

In replying to a letter of thanks from the President, Mr. Humphreys wrote :—

> " Those of us who have the responsibility of running industrial research laboratories would be in very poor shape without physicists, and the value of the physicists themselves is much enhanced through their having The Institute of Physics behind them.
>
> In making the gift of the set of Board Room tables on behalf of our Laboratories, I have not felt that I have been doing more than giving a token of my very sincere appreciation of the magnificent work done by The Institute of Physics and, in particular, by its permanent staff."

A photograph of the now completed Board Room is reproduced on page 60.

The Board Room of the Institute's House.

PHYSICAL METHODS IN THE CARE OF MUSEUM OBJECTS

By F. I. G. RAWLINS, M.Sc., F.S.A., F.R.S.E., F.Inst.P.

This article, written by the Secretary-General of the International Institute for the Conservation of Museum Objects, is intended to convey some idea of the scope of that Institute's work. Although only five years old, its Headquarters are being increasingly consulted from many parts of the world on the subjects discussed below.

When the XVIII century opened there was but one "closet of rarities"—as it was then called—in the Kingdom. To-day even outside the Metropolis and the big cities, there are innumerable collections, some in most unlikely places, but many of them open to the public. It is no part of the present contribution to attempt an assessment of the relative value of these assemblages ; some admittedly are of little importance. But one principle is clear ; if an object is worth keeping at all it is worth keeping properly. It may only be of limited interest and good of its kind. Nevertheless, ownership implies safe custody, and safe custody implies at least a modicum of care for the well-being of material.

It is natural to believe that any scientific approach to the problems of curatorship must be modern. In detail, this may well be so, but there is some evidence to suggest that the Greeks, in the Golden Age of Athens, not only deliberately brought together treasures for further exhibition, but also that they designed buildings to house them, constructed according to the best knowledge then available for securing the optimal environmental conditions.

In our own day, recent years have introduced significant advances in the technique of air-conditioning. The principles are those of classical thermodynamics, but using a working substance (air) the properties of which are far from "ideal." But machinery has been evolved which is economical in operation, and, to a large extent, capable of functioning for long periods with a minimum of supervision. All this has opened a new chapter in the history of museums and galleries. Combined with suitable air-washing plant, not only can the glass be removed from pictures (thereby increasing enormously the pleasure of seeing them without troublesome reflections) but it has become a reasonable proposition to hang walls with rich tapestries, and to introduce furniture of really high quality. Applied physics has thus enabled beautiful things to be seen in comparable surroundings.

The presence of fabrics, furthermore, exerts its own beneficial influence, since such substances act as an efficient steadying valve, absorbing moisture as conditions tend to become too wet, and exuding it slowly when the atmosphere becomes too dry. In fact,

such decorations can be envisaged as a domestic example of cybernetics. In a word, the old barrack-like gallery was as unkind to its contents as it was to the æsthetic sensibilities of visitors. Luckily, it is largely a thing of the past. Fortunate too is the circumstance that, within limits, the range of relative humidity most suitable for the majority of art treasures is also convenient and comfortable for human beings. In general, little harm is likely to occur if the relative humidity can be prevented from falling below fifty per cent, or rising above seventy per cent.

Fig. 1. Interior of part of the air-conditioned war-time repository of the National Gallery.

But delicate objects, somewhat akin to the moving parts of reciprocating machinery, suffer serious "fatigue" if subjected for long periods to alternating stresses. The aim of environmental control should therefore be to narrow the hysteresis loop corresponding to the intake and output of moisture. Thus, a reasonably constant relative humidity around some figure which can be achieved in practice is much preferable to any attempt to work at some value which can only be realized

Fig. 2. National Gallery, London, room XXIX. View above laylight, showing cradle in position for cleaning, and for servicing fluorescent tubes.

under exceptionally favourable circumstances. It is true, however, that remarkable freedom from trouble was experienced at one of our large war-time repositories, in which, for some five years, the desirable level—for wood and canvas—of 58 ± 2 per cent relative humidity was maintained almost without interruption. But this degree of perfection, modest in cost as it turned out to be, is beyond the resources of any but the greatest national collections. In the event, however, the air-conditioning scheme (now in course of extension) at the National Gallery, London, is the direct outcome of war-time experience in " exile," which in its turn was based upon measurements of wood-water relationships and atmospheric pollution tests conducted in the building during 1936-38.

Emphasis upon the conditions under which valuable material is exhibited and stored has resulted in many questions being asked (but by no means always answered) concerning what intensities of illumination, both natural and artificial, are reasonable and safe. By " reasonable " is meant sufficient for normal study and viewing, bearing in mind the costs of initial equipment and upkeep : by " safe " we may denote such an energy-flux which experiment upon " models " of various kinds has shown to be incapable of producing appreciable

fading of colours or deterioration of substances. It is easy to see that circumstances differ to such an extent from place to place, and from substance to substance, that it would be hopeless to attempt the formulation of exact " instructions." But certain basic concepts might well be grasped by all curators and authorities responsible for the conduct of museums and galleries. One is that daylight assuredly always causes some degree of fading, and that if our patrimony is to be seen at all, some risk can scarcely be avoided. Water-colour which is specially susceptible can be kept in drawers or provided with curtains, as is often done. Even fairly prolonged exposure to artificial light may be a minor hazard compared with permanent irradiation by direct sunlight. Indirect lighting is to be preferred when it is practicable, and absorbing screens can usually be devised for use in the confined space within show-cases. Perhaps above all, relative humidity at a high figure is a potent factor in accelerating photochemical action. The " tendering " of fabrics is commonly believed to be an oxidation process, much complicated by the presence of dyes, some of which encourage and others tend to inhibit such deterioration.

It may bring some comfort to those in charge to know that a small committee of physicists, illuminating engineers and chemists is in more or less continuous session in regard to these matters, conducting experiments and tests with the active co-operation of D.S.I.R. and other bodies. This committee has links with corresponding authorities both on the continent of Europe, and in the United States. In this way, international standards are being gradually evolved, and a wealth of day-to-day experience sifted and subjected to the harsh light of objective criticism. The whole project is essentially of a long-term character ; indeed the problems raised become so involved and many-sided that little more than the fringe has been touched. It must always be remembered that in dealing with the well-being of priceless objects, it is not only what may happen to-day and to-morrow which is significant, but what may occur in, say, fifty years time. There is thus an ever-present temptation to extrapolate, with all the pitfalls which such a process conceals.

Nevertheless, progress can be recorded, both in dealing with the inevitable deficiencies of existing buildings and equipment, as well as with evolving principles which may influence—and perhaps modify —the architecture of museums and galleries in the future. New methods of construction and the use of synthetic materials may well play an important part in design during the years to come. The total exclusion of daylight has been achieved in at least one " advanced " gallery, and by careful choice of light fittings, shadows have been almost eliminated.

A branch of activity little appreciated outside professional circles is

that of documentation and recording. It is, of course, vital that accurate data should be tabulated and retained in regard to what in fact was done in the conservation or repair of any important work of art. Surprisingly large gaps sometimes confront the enquirer who sets out to discover when and under what conditions some major operation was performed. It is here, as well as in other directions, that the use of X-ray, ultra-violet, and infra-red radiations are found of substantial value. Alongside these go micro-chemical tests, and the preparation and study of microsections when feasible. All this is, in general, applicable over a wide field, covering such objects as paintings (both panel and canvas), coins and other alloys, ceramics, sculpture and textiles. In fact, one of the advantages which recent co-operation between museum and gallery laboratories has produced is a synthetic approach to the problems of curatorship showing that many apparently diverse cases can be treated by roughly similar scientific methods. At the same time, physical tests, especially optical, have often helped to confirm observations in the field of art history, and thus have made their contribution to the massive scholarship of official dossiers and catalogues. Colour photography and colorimetry have also played a part, both in providing permanent records in relation to the fading of pigments, including the discoloration of surface-coatings, and in some of the routine processes of the restorer's studio.

In recent years, however, it has become apparent that there is a limit to what can be achieved by harnessing the well tried methods of the natural sciences to a variety of *ad hoc* problems as they arise. Otherwise expressed—and closely akin to industrial experience—there is a very real place for fundamental research unconnected with day-to-day affairs, and provided for explicitly as part of a deliberate policy. This is the intention behind the generous grant to the scientific department of the National Gallery by the Nuffield Foundation for a small team to undertake investigations of value to the arts, in the sense that they should contribute to a better understanding of basic principles. In this way, progress has been made in our knowledge of the proximate composition of the natural resins by chromatographic means. And alongside this, new facts are emerging concerning the diffusion of solvents through linoxyn films, and the relation between refractive index and concentration. Again, our information about gloss (especially high gloss) is somewhat deficient, although it is a factor of vital concern over a wide sector of the arts. This subject is being intensively examined : the generally subjective character of gloss makes it all the more imperative to seek quantitative results whenever possible.

In the custody of the Public Records office is the collection of Coram Rege Rolls, with their interesting illuminated headings executed apparently in a kind of miniaturist technique. Some examples display

Fig. 3. The Physics Laboratory at the National Gallery, London, showing the massive easel (with fluorescent screen), ultra-violet equipment to left, and colorimeter in foreground.

considerable artistic merit, whereas others are little more than the crude efforts of the sign-writer. These parchments were examined microscopically by the late Prof. A. P. Laurie, before the first World War, and he was able to state the composition of the pigments used in a number of cases. Lately these rolls have been re-investigated using very soft X-radiation (7.5 kV). Fig. 4 shows a typical result. By means of a micro-densitometer applied to the X-ray films it has been found possible to confirm many of Laurie's observations, and to reject a few. Much of the particular technique and brushwork is revealed, and this sample gives an indication of what low X-ray penetration can accomplish.

Fig. 4. The illuminated heading of Coram Rege Roll No. KB|1294 of the year 1585. X-radiograph. 15 mA. at 7·5 K.V.

Fig. 5. Memorial Panel from Chichester Cathedral (Panchromatic photograph). The micro-section Figs. 7 and 8 were taken from a minute area within the white circle.

An instructive example of the application of physico-chemical processes to museum objects is some recent work at the British Museum Research Laboratory, directed towards the classification of the condition known as tin pest. The allotropy of tin is a well-known phenomenon, but in Europe and the United States the condition of true tin pest is exceedingly rare, and no authentic case of its natural occurrence has been substantiated. When manifestations of such a disease arise, it is confidently believed that they are types of corrosion, which can be treated by invoking the usual methods of electro-chemical reductions.

For some time there has been increasing anxiety over the state of the mural paintings in many cathedral and parish churches throughout the country. Whilst much valuable work has been done, both in attempts to preserve them, and —in suitable instances—to uncover them from behind the layer of lime-wash applied in Puritan times, it is obvious that extensive enquiry will need to be focused upon methods which are safe and effective before this major problem can be said to have been brought under control. That there is a special technical Committee specifically charged with this task is a sign of the times, and upon it two physicists are sitting.

Closely related, and administratively very similar, are the efforts which are being made to ascertain the state of many ecclesiastical fittings, e.g. screens, statues, chests, and the like. Figs. 5, 6, 7 and 8 show an example of a medieval panel from Chichester Cathedral. The captions should enable the structure to be envisaged. The

Layers indicated on figure 8 are as follows :—

I A layer of calcium carbonate and glue.
II An undercoat of red iron oxide, with large granules (*b*) of brown iron oxide.
III A thin line of glue priming.
IV A layer of white lead in glue : with an undispersed lump at (*a*).
V Original layer of gold leaf.
VI Discoloured varnish.
VII Yellow ochre in drying oil.
VIII Gold leaf (modern).

Fig. 6. X-radiograph of part of the panel (Fig. 5).

Fig. 7. Microsection—by reflected light —of the minute sample referred to in Fig. 5. Magnification × 64. For explanation see diagram Fig. 8. and text (page 69).

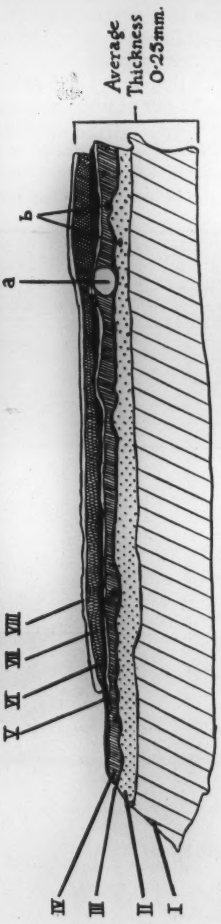

Fig. 8. Illustrating the layers visible in Fig. 7.

The moral to be drawn from these activities is clear, namely that physical methods applied to the arts can help appreciably in the understanding of the structural character of much of our patrimony. In consequence, remedial treatment where needed is the more readily provided. The study of an appropriate environment (i.e. air conditioning, and where this is not possible, at least some attempt at atmospheric control and cleansing) has made progress, and has always aimed at prevention rather than cure. Professionally, some surprisingly diverse occupations have been assembled in support of the whole enterprise ; physicists, chemists, metallurgists, engineers, architects, biologists, all united in a common effort to prolong the life of our national treasure, and to make it more accessible to scholars and to interested public.

The writer would like to express his thanks to Miss R. J. Plesters for help with the illustrations and for the preparation of the diagram, Fig. 8.

Figs. 1 *and* 2 *are reproduced by courtesy of the Ministry of Works, Fig.* 3 *by courtesy of the National Gallery Trustees, Fig.* 4 *by courtesy of the Public Record Office, and Figs.* 5, 6, 7 *and* 8 *by courtesy of the Dean and Chapter of Chichester Cathedral.*

PHYSICAL SOCIETY MEETINGS

Date	*Title*	*Lecturer*	*Place*
April 15, 5.30 p.m. Low Temperature Group	Low Temperature Calorimetry	Dr. D. H. Parkinson Dr. R. W. Hill	London : Science Museum
May 6, 2.30 p.m. Optical Group	A Spectrophotometer for estimating Ozone in the Atmosphere	Dr. R. H. Kay	London : Imperial College
	Optics at the Bureau of Standards	Mr. Feder	
May 13, 5 p.m.	Holweck Discourse	M. A. Kastler	London
May 25, 5 p.m.	Presidential Address	Prof. R. Whiddington	London : Royal Institution
May 26, 3.30 p.m. Colour Group	Subjective White in Colour Television	Mr. W. N. Sproson	London : Institute of Ophthalmology
	Colour Preferences in Television	Dr. M. Gilbert	

REPORT OF THE BOARD OF THE INSTITUTE OF PHYSICS FOR THE YEAR 1953

To be presented for adoption at the Annual General Meeting of the Institute on May 18, 1954

The Board and its Committees

The present Board took office on October 1, 1953 ; its members are :

President : Dr. C. Sykes.

Immediate Past-Presidents : Prof. W. E. Curtis, Dr. F. C. Toy.

Vice-Presidents : Mr. O. W. Humphreys, Dr. T. L. Ibbs, Dr. J. Topping, Prof. F. A. Vick.

Honorary Treasurer : Dr. S. Whitehead.

Honorary Secretary : Dr. B. P. Dudding.

Ordinary Members of the Board : Dr. H. Barrell, Dr. N. A. de Bruyne, Dr. P. S. H. Henry, Mr. G. R. Noakes, Mr. A. T. Pickles, Prof. S. H. Piper, Dr. W. H. Taylor, Mr. R. G. Wood.

Chairmen of Branches in Great Britain : Dr. A. J. Maddock (London & Home Counties), Mr. W. J. Meredith (Manchester & District), Dr. W. Betteridge (Midlands), Mr. H. G. Yates (North Eastern), Prof. W. H. J. Childs (Scottish), Mr. R. G. Wood (South Wales), Prof. E. C. Stoner (Yorkshire).

Representing the Physical Society : Dr. A. B. Wood and Dr. C. G. Wynne.

During the year the Board met six times and appointed the undermentioned Standing and Executive Committees which held twenty-four meetings.

	Chairmen
Finance and General Purposes Committee	The Treasurer.
Membership Committee	Dr. J. Topping.
Education Committee	Dr. W. H. Taylor.
Benevolent Fund Committee	The Treasurer.
Advisory Committee of the British Journal of Applied Physics	Dr. T. E. Allibone.
Advisory Committee of the Journal of Scientific Instruments	Dr. H. Barrell.
Conference and Convention Organizing Committees :—	
2nd Institute Convention — Bournemouth, 1953	Dr. B. P. Dudding.
Static Electrification — London, 1953	Dr. S. Whitehead.
Physics of Particle Size Analysis — Nottingham, 1954	Mr. F. I. G. Rawlins.

Representatives on Joint Committees and other Bodies

The Institute has been represented as follows :

On the Royal Society's National Committee for Physics : Mr. J. H. Awbery.

On the Royal Society's National Committee for Crystallography : Prof. E. G. Cox.

On the Royal Society's Paul Instrument Fund Committee : Sir Frank Smith.

On the Joint Council of Professional Scientists : The President, Dr. S. Whitehead, and Dr. H. R. Lang.

On the Parliamentary and Scientific Committee : Dr. B. P. Dudding and Dr. H. R. Lang on the General Committee, together with Dr. A. J. Maddock and Dr. S. Whitehead at the Annual Meeting.

On the City and Guilds of London Institute's Advisory Committee on the Education and Training of Laboratory Technicians : Mr. N. Clarke, Dr. R. S. Clay and Mr. L. Walden.

On the City and Guilds of London Institute's Advisory Committee on the Training of Instrument Mechanics and Technicians : Mr. N. Clarke.

On the City and Guilds of London Institute Exploratory Committee on Industrial Radiography : Mr. N. Clarke, Mr. F. Y. Poynton and Mr. W. E. Schall.

On the Joint Committee with the Ministry of Education for National Certificates in Applied Physics : Dr. J. S. Forrest, Dr. J. Thomson, Dr. J. Topping and Dr. C. G. Wynne.

On the Joint Committee with the Scottish Education Department for National Certificates in Applied Physics : Mr. T. H. O'Beirne, Dr. R. S. Silver and Dr. A. G. White.

On the British Committee for Radiological Units : Mr. W. Binks.

On the Joint Committee (with the American Society for Testing Materials and The American Crystallographic Association) for Chemical Analysis by X-ray Diffraction Methods : Dr. A. J. C. Wilson.

On the Physics and Mathematics Advisory Committee of the Technical and Scientific Register of the Ministry of Labour : The President and Dr. H. R. Lang.

On the London and Home Counties Regional Advisory Council for Higher Technological Education : Mr. F. Twyman.

On the London Regional Advisory Committee on Applied Physics : Mr. N. Clarke, Mr. F. Y. Poynton and Mr. G. W. Warren.

On the Governing Body of Norwood Technical College : Dr. J. S. Forrest.

On the Sub-Committee on Specialist Courses in Electrical Engineering of the Welsh Academic Board of Technology : Mr. W. S. Vernon.

On the Applied Science Advisory Committee of the Royal Technical College, Salford : Mr. D. A. Crooks.

On the Advisory Committee of the Ipswich School of Technology : Mr. H. A. Nancarrow.

On the Science Advisory Committee of Blackburn Technical College : Dr. A. Hargreaves.

On the Science Advisory Committee of Bury Municipal Technical College : Dr. G. D. Rochester.

On the Applied Science Advisory Committee of the Wolverhampton and Stafford Technical College : Dr. W. Betteridge.

On the East Anglian Regional Advisory Council for Further Education : Mr. H. A. Nancarrow.

On the Yorkshire Council for Further Education Advisory Committee on Applied Physics for the Leeds/Bradford/Huddersfield area : Prof. E. G. Cox, Dr. M. O. Pelton and Dr. D. L. Smare.

On the Yorkshire Council for Further Education Advisory Panel for Physics : Mr. S. L. Anderson, Dr. K. W. Andrews, Dr. M. O. Pelton and Mr. E. Wilfred Taylor.

On the Bucks County Education Committee, Slough Area Science Advisory Committee : Mr. J. Yarwood.

On the Regional Council for Further Education for the South West : Prof. S. H. Piper.

On British Standards Institution Committees : The Institute has been represented on eighteen committees of the B.S.I.

General Meeting — Election of Honorary Fellow

The 33rd Annual General Meeting of the Institute was held on May 29 during the Bournemouth Convention.

At the meeting Professor A. M. Tyndall was declared elected as an Honorary Fellow.

Participating Societies

In last year's Report we stated that the Officers had been asked to re-examine the position of the Participating Societies within the Institute as this had become anomalous. Following discussions with their representatives,

the Faraday Society, the Royal Meteorological Society and the British Institute of Radiology gave notice of withdrawal from participation in accordance with the provisions originally made for this in the Constitution (Article 29). The Physical Society, on the initiative of whose Council the Institute was founded in 1918, is in a different position as most of its members are physicists. Accordingly, it was agreed that that Society should continue to have two seats on the Board of the Institute. It was also mutually agreed that collaboration between the Institute and the Societies should be continued and the meeting of representatives held under the Chairmanship of Dr. Dudding (*Honorary Secretary*) on November 17 made several recommendations. During the year, a permanent joint Committee was set up consisting of representatives of the Physical Society and of the Institute's Electronics Group to ensure that " electron physics " was adequately covered without undue overlap.

The Register

THE ROLL OF THE INSTITUTE

CHANGES DURING 1953

	Total on Dec. 31 1952	*New*	*Transfers to*	*Re-admitted*	*Resigned*	*Deceased*	*Removed*	*Transfers from*	*Net Increase or Decrease*	*Total on Dec. 31 1953*
Hon. Fellows	5	—	1	—	—	—	—	—	+ 1	6
Fellows -	917	15	22	5	6	6	2	1	+ 27	944
Associates -	1616	88	72	4	12	2	6	22	+122	1738
Graduates -	693	152	70	2	6	2	7	61	+148	841
Companions-	—	—	—	—	—	—	—	—	—	—
Subscribers -	441	30	2	2	15	1	9	3	+ 6	447
Students -	675	119	—	—	28	1	66	80	— 56	619
TOTAL -	4347	404	167	13	67	12	90	167	+248	4595

Deaths.—The Board records with regret the deaths reported in 1953 of :— *Fellows :* H. R. F. Carsten, Sir W. T. Griffiths, L. Starbuck, D. G. Underwood, H. P. Waran, R. S. Whipple. *Associates :* A. C. Jessup, S. R. Tibbs. *Graduates :* N. T. Byrom, G. M. D. B. Jones. *Subscriber :* W. A. Calder. *Student :* A. J. Wadsworth.

Membership and Examinations Committee

During the year 581 applications for election or transfer to the various grades were received for submission to the Committee, compared with 651 applications in 1952. The numbers for the grades (with the 1952 numbers in brackets) were : Fellows 48 (36), Associates 179 (153), Graduates 213 (287), Students 111 (141) and Subscribers 30 (34).

The Interview Panel met four times during the year and interviewed sixteen candidates.

Representatives of the Committee visited two technical colleges which had applied for extension of recognition.

During the year the Committee recommended the Board to recognize the degrees of a further four universities. In particular the newly established degree in applied physics of the University of Manchester was recognized, as was the Associateship in Applied Physics of the Royal Technical College, Glasgow.

Mr. G. W. Warren was appointed to be an Examiner to the Committee in place of Mr. A. E. De Barr whose period of office expired. The other Examiner still serving is Professor A. M. Tyndall.

The first holder of the Higher National Certificate in Applied Physics to become an Associate of the Institute was elected during the year.

Education

Graduateship Examination.—The Graduateship Examination was held on June 22–26. Written papers were taken at the Institute's House, at Wigan (Mining and Technical College), at Rotherham (College of Technology) and Paisley (Technical College). The practical examination was held at the Polytechnic, Regent Street, London. The papers were subsequently published in pamphlet form.

Thirty-seven candidates were accepted but five candidates subsequently transferred to the 1954 examination. Of the remainder, 7 satisfied the examiners in those papers which they were required to take. A feature of the examination is the choice permitted to candidates of papers in several branches of applied physics. Thirteen question papers were set. The Examiners were : Professor F. A. Vick, Professor A. M. Tyndall, Dr. J. Topping, Mr. A. E. De Barr, Mr. J. Yarwood, Mr. N. Clarke.

There is every indication that the Graduateship Examination is meeting a definite need : a greatly increased number of candidates had registered by the end of 1953 for the 1954 examination.

National Certificates in Applied Physics.—The number of candidates taking the final examinations for National Certificates in Applied Physics were 151 at the Ordinary level and 55 for the Higher Certificate. These figures compare with 137 and 33 respectively in 1952. The Institute's Assessors were :

England and Wales : Dr. J. Topping, Mr. G. R. Noakes, Mr. G. W. Warren.
Scotland : Dr. G. Morris.

New Reports.—The report of the Education Committee entitled *Problems Concerning the Education of Physicists* dealing with physics in schools, universities and technical colleges, was published in March in the *Bulletin* and as a pamphlet. One session of the Institute's Bournemouth Convention was devoted to the discussion of this report which was well received. The report has received favourable comment in the scientific and technical press.

Publications

As will be seen from the accounts, the Institute's sales of its publications continue to grow satisfactorily ; the development of this side of its work is carefully watched by the Board and its Finance Committee to ensure that it does not form a disproportionately large part of the Institute's activities to the detriment of members' other interests. In January the Publications Policy Committee presented its final report to the Board, which adopted all its recommendations.

The Journals.—The circulation of both Journals again increased during the year and there was a further improvement in the advertisement revenue.

The amount of material submitted to the Journals and published in 1953 is shown in the following table, together with the corresponding figures for 1952.

	J.S.I.		*B.J.A.P.*	
	1953	1952	1953	1952
Extent of Journal text (pages)	501	*416*	(384 + 104 supplement)	*400*
Original papers (numbers) :				
Submitted	162	*180*	136	*82*
Accepted	107	*120*	91	*60*
Published	128	*107*	69	*65*
Special Articles and Reports published	3	*2*	18	*14*
Laboratory and Workshop Notes :				
Submitted	76	*68*	—	—
Accepted	58	*53*	—	—
Published	63	*80*	—	—
New Instruments, Materials and Tools :				
Items published	60	*38*	—	—
Notices of manufacturers' publications ...	20	*58*	—	—
Letters to the Editor published	23	*24*	15	*11*
New Books :				
No. of reviews published	21	*22*	108	*108*

The Board wishes to record its thanks to those Fellows and others who have refereed papers, often involving them in a great deal of time and to those who have reviewed books and assisted the Editor in other ways.

The Advisory Committee of the *Journal of Scientific Instruments* urged the Board to increase the size of the last three issues of the year in order to help reduce the delay in publication ; this was granted. The Committee also caused an inquiry to be made to see if there were not some papers that might better have been published elsewhere. While no firm conclusions could be drawn from this inquiry it was apparent that very few papers came in this category, and which they were, was a matter of individual opinion.

The Advisory Committee of the *British Journal of Applied Physics* reported that there was substantial evidence that the standing of this new Journal had still further improved, but that this could be extended if the delay in publication were reduced and if the scope of the Journal were as wide as possible within the accepted meaning of " applied physics." (Provision has been made for enlargement of the Journal in 1954). The papers presented to the Institute's Conference on " Static Electrification " (see below) and the discussion on them were published as Supplement No. 2 to the *Journal* in December.

Last year we reported that the Board accepted the offer of the Scientific Instrument Manufacturers' Association of Great Britain Ltd. of £50 per annum for three years from its Bowen Trust Fund for the purpose of providing prizes for the best original contributions relating to scientific instruments or their use published in either of the Institute's Journals. The Trust Fund was established by the late Mr. W. Bowen, a Fellow of the Institute. The rules for the award of the prizes, which were approved by the Board during the year, provide that members and non-members of the Institute shall be equally eligible and they must be under 35 years of age.

Bulletin.—The twelve issues of the monthly *Bulletin* (issued to members only) ran to 126 pages, which included summaries of some of the meetings of the Education Group, the Board's Reports on *Problems Concerning the Education of Physicists* and on its *Summary of Salaries and Enrolments* besides a number of

important contributed articles, some of which were based on lectures given before the Institute.

"*Physics in Industry*" *series.*—Dr. G. P. Barnard's *Modern Mass Spectrometry*, a volume of 326 pages with 153 figures, was published in April and had exceptionally favourable reviews. The script of the quarter million word volume *X-ray diffraction by polycrystalline materials* prepared by several members of the X-ray Analysis Group was received at the end of the year.

Monographs for Students.—A project approved by the Board five years ago and mentioned in last year's Report was finally brought to fruition during the year by the publication of the first four booklets in the Institute's new *Monographs for Students* series. These are intended for general reading by students such as those in the first two years of a degree course in science or engineering or those reading for Higher National Certificates. The first four titles were Mr. J. A. Hall's *Fundamentals of Thermometry* and *Practical Thermometry* and Mr. A. E. De Barr's *Soft Magnetic Materials used in Industry* and *The Magnetic Circuit*. They were well received and the sales were sufficiently encouraging for further booklets in the series to be commissioned.

Pamphlets and Reports.—The Report on *Problems concerning the Education of Physicists* originally published in the *Bulletin* was re-issued as a pamphlet and the *Graduateship Examination Papers* set in 1953 were also published in pamphlet form.

Spring catalogue of recent publications.—For the first time in its history the Institute issued a 32-page illustrated list of its recent publications ; 25,000 copies were distributed all over the world and this venture produced good results.

Science Abstracts

Since 1938 members have had the privilege of purchasing copies of both *Physics Abstracts* and *Electrical Engineering Abstracts* at reduced rates if purchased through the Institute. This publication is owned and produced by the Institution of Electrical Engineers under the supervision of a Management Committee, which desires to maintain and improve the service, despite rising costs. The Board, wishing to assist members to continue to support this important publication agreed to make a modest annual basic payment to the Committee from its publications account, in order that the reduced price to members should not have to be increased appreciably. The Board also accepted an invitation for the Institute to be represented on the Management Committee. The new agreement is to be reviewed in three years' time.

Professional Matters

Salary statistics.—The Board authorized a further inquiry to be made of members concerning their remuneration, similar to those made in 1948 and 1951. A report on the analysis of the data was published in the *Bulletin* in December and reprints have been widely distributed among universities, industrial firms and other employers of physicists ; many requests for additional copies were received.

Recognition of Grad.Inst.P.—Through the good offices of the Chairman of the Manchester and District Branch the Grad.Inst.P. was recognized locally for the purposes of pay increments of certain grades in the National Health Service.

Professional advice.—The permanent officers have again dealt with many inquiries from both members and non-members concerning such items as

appropriate education and training in physics and its special branches, consulting fees and salaries, deferment from military service, and the content of certain advertisements. The Board records here its thanks to the several Fellows who have been good enough to assist in the work.

Civil Defence

In last year's Report mention was made of a proposed meeting between representatives of professional bodies of qualified scientists and of the Home Office to consider difficulties connected with recruitment and training of volunteers for civil defence. The Board had before it copies of new circulars issued by the Home Office and in view of these decided not to press for such a meeting until the result of these instructions to local Civil Defence Corps had been noted. The permanent officers have continued to assist local corps commanders within the framework laid down by the Board last year.

The Institute's House

During the summer the Board Room of the Institute's House was among those redecorated. A carpet and twenty-four armchairs upholstered in red leather to match the Presidential Chair presented by the South Wales Branch were bought from money provided by the Brown Firth Research Laboratories. The set of specially designed tables for the Board Room to be provided by the Research Laboratories of The General Electric Co. Ltd. were also ordered. The Board gratefully acknowledges these generous gifts.

The number of meetings held in the House during the year compared with the previous year is given in the following table.

Institute meetings	1953	*1952*
Board and Committee meetings (including Branch and Group Committees)	78	*73*
Conferences and Lecture meetings	29	*27*
Social functions	9	*7*
Other meetings		
The rooms have also been used by other bodies as follows :		
Committee meetings	14	*15*
Lecture meetings	13	*11*

It was with the greatest pleasure that the Board acceded to the request of the owner of the House, the Earl of Mount Edgecumbe, a former member of the Board, to hold a reception in the House on the eve of the Coronation.

Convention and Conferences

2nd Institute Convention.—About 450 members, ladies and guests attended the Institute's second Convention which was held at Bournemouth, from May 27–30.

The two main scientific lectures were by Dr. A. C. Menzies (" Recent developments in applied optics ") which was published in the December issue of the *Journal of Scientific Instruments*, and Sir John Cockcroft (" Recent advances in nuclear physics ") which was published in the October issue of the *British Journal of Applied Physics*.

On the evening of May 28 Dr. C. E. Raven spoke on " The impact of physics on science and religion," and an approximate text of the lecture which he kindly provided was published in the July issue of the *Bulletin*.

Other sessions of the Convention included a discussion on the education of physicists and twelve Group meetings at which twenty-three papers were read. There were also several social functions and visits to laboratories, factories and local beauty spots.

Conference on Static Electrification.—A conference on " Static Electrification " was held at Bedford College, London, on March 25–27, 1953. The total attendance was 200. Twenty-four prepared contributions were presented to the Conference of which sixteen of the more specialized papers were available as pre-prints. The proceedings were published as Supplement No. 2 to the *British Journal of Applied Physics* in December.

Other Conferences.—As in previous years the Institute was associated with the Summer School and Conference organized by the University of Bristol on " The Theory of the plastic deformation of Metals " and held on July 13–16 at Bristol.

The Institute, among other bodies, was also associated with a Conference organized by the Clarendon Laboratory, Oxford, on " Ionization phenomena in discharges " which was held from July 18–23.

Several specialists Conferences were held by the Institute's Branches and Groups and these are briefly reported below.

Annual Conference of Branch and Group Officers

The tenth Annual Conference of Honorary Officers of Branches and Groups was held at the Institute's House on July 10, the senior Vice-President (Prof. E. G. Cox) being in the Chair. Twenty-five honorary officers attended. A number of domestic matters were discussed and recommendations made to the Board.

As a result of this meeting Group Committees may now put forward names for nomination by the Board for election to the Board. Hitherto this privilege has been confined to local Branches.

Activities of the Branches and Groups

Australian Branch.—President : Professor L. H. Martin. *Honorary Secretary :* Associate Professor E. O. Hercus. *Honorary Treasurer :* Dr. J. S. Rogers. (389 members).

The Divisions of the Branch in the different States have held regular meetings, monthly in the case of four of the States. Mr. O. W. Humphreys (a Vice-President of the Institute) and other visitors from Great Britain have addressed meetings.

Indian Branch. — Chairman : Sir C. V. Raman. *Honorary Secretary :* Dr. H. P. Waran succeeded by Mr. T. N. Seshadri. (90 members).

The Branch Committee has advised the Membership and Examinations Committee on applications received from India.

London and Home Counties Branch.—Chairman : Dr. A. J. Maddock. *Honorary Secretary :* Mr. B. S. Cooper. (1930 members).

Six lecture meetings were held in London. An " At Home " was held in the Institute's House in October and was well attended by members and their guests. A visit was arranged in April to the new laboratories of the Physics Department of King's College, London. The Summer Meeting was held at the College of Aeronautics, Cranfield, Bedfordshire.

Manchester and District Branch.—Chairman : Mr. W. J. Meredith. *Honorary Secretary :* Dr. C. C. Butler succeeded by Dr. D. G. Drummond. (451 members).

Seven lecture meetings were held at the University of Manchester, one jointly with the Electronics Group.

Midland Branch. — Chairman : Dr. T. L. Ibbs succeeded by Dr. W. Bettridge. *Honorary Secretary :* Mr. W. C. Hynd. (426 members).

Seven lecture meetings were held in Birmingham. In December a visit was arranged to Henry Wiggin & Co. Ltd. and the Mond Nickel Research Laboratories.

Scottish Branch.—Chairman : Professor J. S. Rankin succeeded by Professor W. H. J. Childs. *Honorary Secretary :* Mr. J. McNeill succeeded by Mr. T. H. O'Beirne. (277 members).

Seventeen lecture meetings were held in Glasgow, ten in Edinburgh, three in Dundee and one in St. Andrews.

South Wales Branch. — Chairman : Dr. T. V. Starkey suceeded by Mr. R. G. Wood. *Honorary Secretary :* Mr. M. R. Hopkins. (214 members).

Three lecture meetings were held in Cardiff, two in Swansea and one in Aberystwyth.

North Eastern Branch.—Chairman : Mr. H. G. Yates. *Honorary Secretary :* Dr. N. Thorley. (104 members).

Five meetings were held in Newcastle and one in Sunderland. A summer meeting was held in Durham City.

Yorkshire Branch.—Chairman : Professor E. C. Stoner. *Honorary Secretary :* Dr. R. S. Tebble. (190 members).

Meetings were held at Leeds and Sheffield, and the Summer Meeting was held at Messrs. Cooke, Troughton & Simms, York.

Education Group.—Chairman : Mr. W. Somerville Vernon succeeded by Dr. J. Topping. *Honorary Secretary :* Mr. F. Y. Poynton. (266 members).

Four lecture meetings were held in London.

Electronics Group.—Chairman : Mr. G. W. Warren. *Honorary Secretary :* Mr. S. Rodda. (330 members).

Six meetings were held in London and one at Manchester jointly with the Manchester Branch. A spring visit was made to the Associated Electrical Industries Ltd. Research Laboratory, Aldermaston.

Electron Microscopy.—Chairman : Professor W. T. Astbury succeeded by Dr. V. E. Cosslett. *Honorary Secretary :* Dr. R. Reed. (246 members).

The Group held its annual Conference at Birkbeck College, London.

Industrial Radiology Group.—Chairman : Mr. W. E. Schall. *Honorary Secretaries :* Mr. R. Meakin and Mr. B. R. Byrne. (250 members).

Six meetings were held in London and a two-day meeting was held jointly with the Hospital Physicists' Association at the Royal Institution, London.

Industrial Spectroscopy Group.—Chairman : Mr. D. M. Smith. *Honorary Secretary :* Mr. J. R. Stansfield. (158 members).

Three lecture meetings were held in London.

Stress Analysis Group. — Chairman : Col. H. T. Jessop succeeded by Mr. E. K. Frankl. *Honorary Secretary :* Mr. E. K. Frankl succeeded by Mr. B. Sugarman. (130 members).

One lecture meeting was held in Sheffield and a visit was made to the Engineering and Applied Mechanics Laboratories of the University of

Sheffield. A meeting was held in London at the Institute's House. The annual Group Conference was held at the University of Cambridge.

X-Ray Analysis Group.—Chairman : Dr. W. H. Taylor succeeded by Mr. H. P. Rooksby. *Honorary Secretary :* Mr. E. J. W. Whittaker. (385 members).

The Autumn Conference of the Group was held in the Institution of Electrical Engineers, London. The subject of the Conference was " Film Methods and Microdensitometry " and " Identification by X-Ray Analysis." An exhibition of X-Ray crystallographic equipment was held in conjunction with the Conference.

Work has continued at the University College, Cardiff, on the extension of data for the index of diffraction data published by the America Society for Testing Materials. The Group's Equipment Sub-Committee has been reconstituted and has continued its work.

Acknowledgments

Branch and Group Officers.—The Board wishes to record its thanks to those members who have acted as Honorary Officers of the Institute's Branches and Groups and who have thereby contributed greatly to the Institute's activities.

Meeting Rooms and Visits.—The Board records its thanks to the many bodies which have generously allowed meetings of the Institute's Branches and Groups to be held on their premises or which have allowed visits to their laboratories.

Finance

The general lay-out of the accounts follows the usual form save that the presentation of the Balance sheets have been modified in an attempt to make it simpler to follow the details.

The basis of allocation of overheads (salaries, wages, cost of running the House and office, etc.) is that adopted last year. Taking the Institute's affairs as a whole, i.e. combining the Institute's own account (surplus £3,287) with that of its Trust Fund (which bears the whole cost of the Institute's scientific and educational work and has a deficit of £2,797) there is a final net surplus of £490.

The Institute of Physics Accounts. The income and expenditure account does not call for comment beyond that made above. The balance sheet is arranged to show how the present values of the fixed assets have been arrived at. The gifts to the Furnishing Fund (mentioned elsewhere in this report), are shown on the left hand side of the account, but the value of the furniture purchased £924 is deducted also on the left hand side and therefore is not included as an asset under " Furniture and Fittings " on the other side. In pursuance of the policy repeatedly mentioned in these reports it will be noted that during the year the Institute's investments were increased from the very low figure of £2,901 to £5,657.

Endowment Trust Fund Accounts. The most satisfactory feature of the Fund's income and expenditure account is the continued financial success of the Institute's publications as a whole. Last year it was explained that the Board considered it " prudent to put back to reserve the whole of the proceeds of the sales of books until their cost of production has been written off " ; this year the figure for this is £1,566, which it will be seen accounts for a substantial portion of the deficit shown on this account. The Board wishes to express

its thanks to those firms who continue to subscribe to The Fund, and to the Council of the Royal Society for a subvention from the Parliamentary Grant-in-Aid for Scientific Publications.

The X-ray Index Fund (which is held in Trust for the X-ray analysis Group) has been transferred from the Institute's account to that of the Endowment Trust Fund, where it more properly belongs, as the work is of scientific interest as distinct from " professional."

As usual a substantial sum has been received in advance for subscriptions to the new volumes of the Journals and this is shown under current liabilities as the service has still to be rendered in respect of this money. The accounts for the last quarter of the year are not settled until after the end of the year ; for this reason, on the one hand, an amount of £3,371 was owing for printing and publishing bills, and on the other the sum of £4,598 was due to the Trust Fund from sundry debtors to the publishing account.

The stock of publications and wrappers on hand has increased by £1,421 but against this there is a depreciation reserve of £2,219 giving a net, conservative figure of £6,258 as the value of the stock of publication available for sale.

Benevolent Fund

Unlike last year there have been no large donations to the Fund ; the Committee wishes to express its thanks to the many members who have subscribed to it during the year, to those responsible for the books, the royalties from which are credited to the Fund, and to a group in the Royal Naval Scientific Service who made a special donation.

During the year it was learnt that under the Will of the late Mrs. W. Phillips (widow of Major C. E. S. Phillips—who inaugurated the Fund in 1924) there was a substantial provision for the benefit of the Fund. The executors and trustees appointed under the Will have not so far been able to complete their work and the exact benefit to be expected from this bequest is therefore not yet known.

Weekly allowances have been made to the widows and children of two Associates and grants to two members who were in need.

Reports from Representatives on Joint Committees and other Bodies

Parliamentary and Scientific Committee.—This body has again had an active year ; the General Committee met eight times. The business meetings which bring the attention of Parliamentarians to matters of public interest connected with science and technology are followed by addresses by one or more distinguished visitors who then reply to questions on their remarks. Among the subjects touched on in this way during the year were the exploitation of science by industry and higher technological education both in an important address to the Committee by the Lord President of the Council ; on another occasion there was an interesting discussion on the application of science to the electricity and gas industries. A number of visits were made by members of the Committee to research establishments and the Institute's representatives took part in several of these. At the annual meeting Dr. S. Whitehead (Treasurer of the Institute) was elected one of the Honorary Secretaries of the Committee.

Once again through the good offices of the Parliamentary members of the Committee it has been possible to keep matters of urgent public and scientific importance before the Ministries concerned. A Sub-Committee consisting of

a few members from each House was set up to " see what further guidance and encouragement could be given to the Government about its proposed plans for the expansion of higher technological education " and various bodies representing professional scientists have been invited to put their views before it.

Joint Council of Professional Scientists.—The purpose of the Joint Council is to provide opportunities for the regular interchange of views between representatives of professional bodies of qualified scientists. The discussions at its January and November meetings were concerned with the transferability of pension rights, the shortage of science teachers in schools, and of suitable candidates for university courses in technology, scientists in Civil Defence, and higher technological education.

Royal Society's National Committee for Physics.—The Committee has had before it the recommendations of the Joint Commission for spectroscopy and an enquiry concerning glossaries of physical terms. Its principal work has been preparation for the General Assembly of the International Union of Pure and Applied Physics in London in 1954.

British Committee for Radiological Units.—The Committee submitted a report to the International Commission on Radiological Units, proposing certain revisions of the 1950 Recommendations of the Commission. The statement to I.C.R.U. included the following : (*a*) Recommendations regarding the fundamental unit of ionizing radiation, expressed in ergs per gramme of absorbing material, (*b*) Extensive revisions of the sections dealing with the specifications of conditions of X-ray and γ-ray treatments and with instruments, (*c*) Reports giving the present position concerning values of mass stopping powers of materials and values of average energy expended per ion pair formed in a gas. Direct measurements of ionizing radiations in ergs per gramme are far less practicable than ionization measurements. The above values are therefore necessary to enable the dose in absolute units to be assessed from the ionization values, (*d*) Report on values for the dose rates from γ-ray emitting radioactive isotopes.

Royal Society's Paul Instrument Fund Committee.—This Committee has met several times during the year and made a number of substantial grants for the construction of novel types of physical instruments. A report on the work of the Committee was published in *Nature* for February 13, 1954.

Joint Committee (with the American Society for Testing Materials and The American Crystallographic Association) for Chemical Analysis by X-ray Diffraction Methods.—The Joint Committee has pursued its usual activities, and a new supplement to the card index (the fifth set) is with the printers. Expert sub-editors for special groups of cards, such as minerals, organic compounds, etc., have been appointed, and this is expected to bring about a gradual improvement in the standard of the data.

London Regional Advisory Committee in Applied Physics.—A sub-committee has has been working throughout the year on the preparation of a detailed scheme for a full time course in Applied Physics of degree standard. This has been considered by the Advisory Committee and referred back for the incorporation of various suggestions. It has also been decided that the scheme shall be submitted to the Institute and the views of the Institute's Education Committee invited.

Regional Council for Further Education for the South West. A Panel has been set up to advise Local Education Authorities upon problems met in organizing

special courses in higher technology, and the Council has also undertaken to advise them about specialist lecturers from industry and other sources who might help by giving lectures in their subjects and a list of such lecturers is being compiled. It appears that the demand in the area was insufficient to require the provision of courses in applied physics leading to the Ordinary National Certificate, but it is hoped that one such course will be started in Bristol during the current year.

City and Guilds of London Institute—Exploratory Committee on Industrial Radiography.—This Committee and its Sub-Committee has held several meetings and its report and draft syllabus was submitted to the parent body at the end of the year.

Science Advisory Committee of Blackburn Technical College.—The Committee met one during the year. Proposals for the development of the Physics Department, submitted by the Principal of the College, include the addition of a laboratory for teaching advanced physics.

Advisory Committee in Applied Science of Wolverhampton and Stafford Technical College.—The first meeting of this newly constituted Committee was devoted to a review by the College staff of the organization and activities of the Department of Applied Science. Reports covering the work of the previous session were presented.

Science Advisory Sub-Committee of Poole College for Further Education.—An inaugural meeting was held in June. Although the main business was not directly related to physics instruction it was possible to study plans of the physics laboratory included in the new permanent buildings shortly to be erected. The new facilities may enable more advanced tuition in physics to be given at Poole than has been possible previously.

BRITISH STANDARDS INSTITUTION COMMITTEES

Instrument Industry Standards Committee.—At its annual meeting this Committee reviewed the work of its several Sub-Committees dealing with the standardization of certain instruments or parts of instruments and with proposals for new work. In the discussion on the standardization of terminology and symbols for instruments, reference was again made to the need for the trade names of instruments to give some indication of their function.

Technical Committee on Abbreviations and Symbols.—The Committee held an all day meeting in September to consider the many comments received on its draft new British Standard entitled " Letter Symbols, Signs and Abbreviations: Part I General." This basic specification is of the utmost value and importance to all concerned with the writing and printing of scientific literature particularly involving mathematics and it is not, therefore, surprising that so many conflicting requirements and interests have had to be reconciled. It is hoped that it will be published early in 1954.

Technical Committee on Electric Nomenclature and Symbols.—The work has been strongly influenced by the I.E.C. discussions on the M.K.S. system. Although there is general approval of the I.E.C.'s decision to adopt the rationalized M.K.S. system yet serious divergences have appeared in the interpretation of this decision. Important steps were taken during the year towards composing the differences but there remain serious difficulties in the production of a consistent and acceptable nomenclature and definitions.

Technical Committee on Glossary of Rubber Terms.—The newly formed Committee's one meeting was devoted to a consideration of the scope of its future work.

Technical Committee on Electronic Tubes and Valves.—This Committee has been very active and the result of several years' labour has appeared in a new edition of the British Standard " Electronic Bases, Caps and Holders," which has just been published. This document covers such physical requirements of the bases and caps, and in some cases outlines of electronic valves and their associated holders and connectors, as are necessary for mechanical compatability and satisfactory electrical contact. The work is being continued.

Joint Sub-Committee with the Institution of Electrical Engineers on Code of Practice on the use of Electronic Valves.—This Committee has been active in the preparation of a new Code of Practice which will be published in parts. The first will appear within a few months, and will deal with general matters and will give recommendations for all electronic valves. Part II, dealing with receiving valves, cathode ray tube and rectifiers will probably appear at the same time as Part I. Subsequent parts dealing with photocells, transmitting valves, etc., are well in hand.

Technical Committee on Standardization of Radiology.—This Committee held one meeting during the year at which the work of the various Sub-Committees was reviewed. A draft Standard for shockproof X-ray tube cable terminations and receptacles was approved for submission to the Electrical Industry Standards Committee. A draft standard for protective gloves had been prepared and circulated for comment. The position regarding standards for diagnostic X-ray equipment and for therapeutic X-ray equipment was discussed as was the advisability of standardizing X-ray film cassettes and monitoring film holders.

Technical Committee on Radiographic Examination of Welded Joints.—An enlarged panel has been formed to review the draft set of radiographic techniques.

Technical Committee on X-ray Film Processing Units.—Meetings have been held about every 6 weeks, and a draft Standard for " 5 and 10 gallon X-ray processing units " was circulated for comment.

Sub-Committee on X-ray Film Processing, Workroom and Finishing Equipment and Accessories.—Meetings have been held about every 6 weeks, and a draft Standard for " Dimensions of processing tanks " was prepared. A draft standard for " Dimensions of processing hangars for X-ray film and sheet film " has also been prepared.

Sub-Committee on Terminology of Casting Defects.—The draft specification has been circulated and many comments on details have been received and are being incorporated in a final specification.

Sub-Committee on Terminology of Radiology.—The Sub-Committee has continued to meet regularly and to make steady progress in the drafting of definitions. It is hoped that the Glossary will be published in about six months' time.

C. SYKES,
President.

S. WHITEHEAD,
Honorary Treasurer.

H. R. LANG,
Secretary.

B. P. DUDDING,
Honorary Secretary.

THE INSTITUTE

INCOME AND EXPENDITURE ACCOUNT

1952 £		£
	To Office and General Expenses :—	
2,640	Salaries and National Insurance	3,071
90	Staff Superannuation	121
666	Rents, Rates, Heating, Cleaning, Maintenance, etc.	966
636	Board, Committees' and Officers' Travelling Expenses	782
555	Printing and Stationery	862
254	Postage and Telephones	290
192	Miscellaneous Expenses	138
5,033		6,230
320	„ Depreciation of Furniture and Fittings	344
1,814	„ Copies of Journals supplied to Members	1,646
515	„ Amount written off Expenditure on Alterations, Improvement and Adaptation of House	378
985	„ Leasehold Redemption Policy	985
3,664	„ Balance being Excess of Income over Expenditure carried down	3,287
£12,331		£12,870
92	To Balance brought forward from previous year ...	—
3,572	„ Balance to Reserve Fund	3,287
£3,664		£3,287

OF PHYSICS

FOR THE YEAR ENDED 31ST DECEMBER, 1953

1952			
£			£
10,283	By MEMBERS' SUBSCRIPTIONS		10,863
638	„ ENTRANCE AND OTHER FEES		646
132	„ DIVIDENDS AND INTEREST LESS TAX		80
	„ CONTRIBUTION FROM THE ENDOWMENT TRUST FUND for alterations of premises, depreciation of furniture and fittings, and leasehold redemption policy :		
	Charged to cost of Publications	£854	
	Charged to other work	427	
1,278			1,281
£12,331			£12,870
3,664	By BALANCE BROUGHT DOWN		3,287
£3,664			£3,287

THE INSTITUTE

BALANCE SHEET,

1952 £		£	£
	LIFE MEMBERSHIP FUND :—		
	As at 31st December, 1952	5,053	
	Less : Transfer to Reserve Fund in respect of deceased members	53	
5,053			5,000
	RESERVE FUND :—		
	As at 31st December, 1952	5,809	
	Add : Transfer from Life Membership Fund ...	53	
	Sinking Fund, Leasehold Property ...	3,940	
	Income and Expenditure Account Balance	3,287	
8,764			13,089
	FURNISHING FUND :—		
	Donations received to 31st December, 1952 ...	500	
	Received during the year	632	
		1,132	
	Less : Expenditure to date	924	
71			208
	CURRENT LIABILITIES :—		
	Payments received from members in advance ...	688	
	For Expenses	1,780	
	Due to Endowment Trust Fund	1,480	
6,214			3,948
	C. SYKES, *President.*		
	S. WHITEHEAD, *Honorary Treasurer.*		
£20,102			£22,245

Report of the Auditors to the

We have obtained all the information and explanations which to the best our opinion proper books of account have been kept by the Institute so far as the purposes of our audit have been received from Branches of the Institute not and Expenditure Account which are in agreement with the books of the Institute. tions given to us the said Accounts give the information required by the Companies view of the state of the Institute's affairs as at 31st December, 1953, and the Income over Expenditure for the year ended on that date.

Spencer House, South Place, London, E.C.2.
15th February, 1954.

OF PHYSICS

31ST DECEMBER, 1953

1952		Cost to 31/12/52	Additions during year	Depreciation to 31/12/52	Depreciation during year	
£		£	£	£	£	£
	FIXED ASSETS :—					
1,898	FURNITURE, FITTINGS & OFFICE EQUIPMENT ...	4,262	330	2,364	344	1,884
7,562	ALTERATIONS, IMPROVEMENTS AND ADAPTATION OF PREMISES ...	10,290	—	2,728	378	7,184
9,460						9,068
	CURRENT ASSETS :—					
502	STOCK ON HAND—Stationery				330	
344	DEBTORS—Sundry Accounts				347	
242	SUBSCRIPTIONS IN ARREARS				48	
	INVESTMENTS :—					
1,737	Quoted				4,485	
1,164	Unquoted				1,172	
	(*Estimated Market Value on 31st December, 1953, £5,521*)					
2,955	LEASEHOLD REDEMPTION POLICY				3,940	
3,698	BANK BALANCES AND CASH IN HAND				2,855	
10,642						13,177
£20,102						£22,245

Members of the Institute of Physics.

of our knowledge and belief were nccessary for the purpose of our audit. In appears from our examination of those books, and proper returns adequate for visited by us. We have examined the above Balance Sheet and annexed Income In our opinion and to the best of our information and according to the explana- Act, 1948, in the manner so required and the Balance Sheet gives a true and fair Income and Expenditure Account gives a true and fair view of the Excess of

KNOX, CROPPER & CO., *Chartered Accountants.*

THE INSTITUTE OF PHYSICS'

INCOME AND EXPENDITURE ACCOUNT

1952				
£				£
321	To Graduates and National Certificates Examinations ...			371
1,608	„ Expenses of Branches and Groups			1,793
116	„ Conference Expenses			873
2,573	„ Glasgow Conference Expenditure			—
113	„ Educational Booklets and Reports			83
	„ Cost of Production and Distribution of Publications sold	£26,838		
	Add : Book Stock depreciation reserve	1,566		
23,208				28,404
4,223	„ Proportion of overhead charges in connection with the work carried on by the Trust			5,018
626	„ Contribution to cost of repairs and alteration of House, depreciation of furniture, and Leasehold Redemption Fund			427
£32,788				£36,969

BALANCE SHEET,

*1952**				
£			£	£
	ENDOWMENT TRUST FUND :—			
	As at 31st December, 1952		6,631	
	Less : Transfer from Income and Expenditure Account		2,797	
6,631				3,834
	CURRENT LIABILITIES :—			
—	X-Ray Index Fund		7,553	
10,712	Publications, Subscriptions in advance		7,551	
2,093	Printing and Publishing Expenses		3,371	
50	Bowen Prize Fund		3	
				18,478

C. SYKES, *President.*
S. WHITEHEAD, *Honorary Treasurer.*

£19,486	£22,312

We have audited the above Balance Sheet and have obtained all the Bank Balances and the Investments. In our opinion such Balance Sheet is Fund according to the best of our information and the explanations given to

Spencer House, South Place, London, E.C.2.
15th February, 1954.

* *Some of these figures are not strictly comparable with the 1953 figures.*

ENDOWMENT TRUST FUND

FOR THE YEAR ENDED 31ST DECEMBER, 1953

1952			
£			£
225	By	Fees for Examinations	306
164	„	Donations	164
49	„	Interest	119
20	„	Income Tax recovered	20
27,925	„	Receipts from publications, including advertisements ...	33,263
500	„	Scientific Publications Grant (per Royal Society) ...	300
3,563	„	Glasgow Conference Income	—
342	„	Balance carried to Endowment Trust Fund	2,797
£32,788			£36,969

31ST DECEMBER, 1953

*1952**				
£			£	£
1,900	GOVERNMENT SECURITIES, at cost ... ... (*Estimated Market Value on 31st December, 1953, £3,808*)			3,809
	STOCK ON HAND, PUBLICATIONS AND DISPATCH MATERIAL	8,477		
	Less : Book Stock depreciation reserve, 31/12/53	2,219		
6,403				6,258
7,679	SUNDRY DEBTORS, PUBLICATIONS, ETC.			4,598
Cr. 1,996	DUE FROM THE INSTITUTE OF PHYSICS			1,480
5,500	BANK BALANCES AND CASH IN HAND			6,167
£19,486				£22,312

information and explanations we have required. We have verified the properly drawn up so as to exhibit a true and correct view of the state of the us and as shown by the books of the Fund.

KNOX, CROPPER & CO., *Chartered Accountants.*

THE INSTITUTE OF PHYSICS'

INCOME AND EXPENDITURE ACCOUNT

1952			
£			£
276	To Grants		421
15	„ Printing and Stationery		—
1,447	„ Balance being excess of Income over Expenditure carried to Capital Account		408
£1,738			£829

BALANCE SHEET,

1952			
£		£	£
	CAPITAL ACCOUNT :—		
	On 31st December, 1952	3,762	
	Add : Transfer from Income and Expenditure Account	408	
3,762			4,170
	S. WHITEHEAD, *Chairman of Fund Committee.*		
	H. R. LANG, *Secretary of Fund Committee.*		
£3,762			£4,170

We have audited the above Balance Sheet and have obtained all the informa- and the Investments. In our opinion such Balance Sheet is properly drawn up the best of our information and the explanations given to us and as shown by the

Spencer House, South Place, London, E.C.2.
15th February, 1954.

BENEVOLENT FUND

FOR THE YEAR ENDED 31ST DECEMBER, 1953

1952		
£		£
1,508	By Subscriptions and Donations	562
68	„ Interest	117
162	„ Royalties on Books	150
£1,738		£829

31ST DECEMBER, 1953

1952		
£		£
1,679	GOVERNMENT SECURITIES at cost ... ... (*Estimated Market Value on 31st December, 1953, £2,465*)	2,633
918	DEBTORS	114
570	CASH ON DEPOSIT AT POST OFFICE SAVINGS BANK	1,096
595	CASH AT BANK	327
£3,762		£4,170

tion and explanations we have required. We have verified the Bank balances so as to exhibit a true and correct view of the state of the Fund according to books of the Fund.

KNOX, CROPPER & CO., *Chartered Accountants.*

REVIEWS OF BOOKS

Circuit Theory of Electron Devices. By E. MILTON BOONE. (New York : John Wiley & Sons, Inc. London : Chapman & Hall Ltd.) Pp. vii + 483. Price 68s.

Professor Milton's book has been written primarily for college and university students and has been based on his experience at Ohio State University in teaching engineering students who have pursued preliminary courses of study in mathematics, including differential and integral calculus, physics and some circuit theory.

The first chapters are devoted to the circuit theory of diodes, triodes, tetrodes and pentodes, four-terminal-network theory being applied to the operation of these tubes in the linear region of their characteristics. Then follow sections on audio-frequency amplifiers and power stages, gas-filled tubes, single phase and polyphase rectifiers, radio-frequency amplifiers and oscillators, and a complete chapter is devoted to modulation and demodulation. The book concludes with an excellent chapter on the circuit properties of transistors, prefaced by consideration of some of the fundamental physical concepts involved in the operation of these devices. Circuits involving magnetrons and velocity-modulated tubes are not considered and are probably regarded as beyond the intended scope of a two-semister course.

In the preface the author states that the fundamental emphasis is devoted to the circuit theory and not to the physics of electron devices. He does not assume this physical knowledge but expresses his belief that analysis for the beginning student of electron devices should be limited at first to the circuit properties, properties that can be determined by measurements at available terminals. The thermionic valve, photocell or transistor is merely a " black box " with input and output terminals. Certain characteristics of the device may be determined and hence its behaviour explained and predicted. In studying circuit theory this approach is perfectly logical and, indeed, is justified, since fundamentally most of what we know about electron devices derives from their behaviour in circuits and our knowledge is restricted by the limitations imposed by the circuits in which they are used.

Professor Boone's book, however, covers more than mere circuit theory. Numerous practical applications are given in the form of well chosen example problems, and there are problems at the end of each of the twelve chapters for the student to solve. The book is written for students who are going to become engineers and who, if they are to use valves and transistors intelligently will require to know

something about the "black boxes" themselves and about the fundamental physical phenomena on which their action depends. How otherwise will the student realise the limitations of and avoid damage to the device ? Will he realize that the characteristics of the device, unlike the other circuit components, vary with time ? It is true that, throughout the first few chapters, there are brief, if sometimes rather inadequate, explanations of the reasons why certain types of tube have certain characteristics ; but a short introductory chapter on the physics and properties of the tube itself, treated quite simply, would in the reviewer's opinion, have enhanced considerably the value of the book to the " beginning student." In the last chapter on " Circuit Theory of Transistors," this is in fact what the author does, and in the space of twelve pages gives an excellent introduction to the fundamental physical concepts.

It is a little surprising that " noise " is hardly mentioned. The student, from his preliminary study of physics, should be familiar with the fundamentals of the subject, and electronic tubes and circuits provide important illustrations of the limitations imposed by this phenomenon.

The book is extremely well written and produced and is illustrated by clear diagrams. The subject matter is treated with a thoroughness which reveals an experienced teacher who can make his subject interesting to the student.

G. W. WARREN.

Security and Responsibility (Alex Wood Memorial Lecture, 1954). By KATHLEEN LONSDALE, F.R.S. (London : The Fellowship of Reconciliation). Pp. 32. Price 1s. 6d.

This is the third of the annual lectures established to honour the memory of a much respected physicist, a great Christian and a tireless social worker. In it Kathleen Lonsdale, who herself well merits that description of Alex Wood, discusses the modern world's preoccupation with military and social security, to the establishment of both of which the scientist is commonly supposed to have a vital contribution to make. There is almost nothing in this lecture that does not urgently need to be said. To those who claim to cherish the Christian ethic, even more to those of us who accept the faith, this is a challenge which may well be ignored but which will not easily be answered. The last four pages of the pamphlet, in particular, reach to the heart of the moral and spiritual problems of our day.

One could but wish that all science students would read the lecture and that those (alas, one expects, the majority) who were unable to accept its conclusions were of such intellectual stature that they could

give cogent reasons for rejection. The exercise might be a valuable corrective to those whose first tendency would be to dismiss as naive Kathleen Lonsdale's plea that we need to take literally the saying that we should become as little children. NORMAN CLARKE.

An Introduction to Relaxation Methods. By F. S. SHAW. (New York : Dover Publications, Inc.) Pp. 396. Price $5.50.

In his recent Thomas Hawkesley Lecture " Relaxation Methods : A Retrospect," Sir Richard Southwell exhibits examples of relaxation work by three of his pupils. One of these is the author of this book.

Notwithstanding an opening chapter which explains the origin and terminology of the methods in relation to pin-jointed frameworks, the reviewer (and, no doubt, the author) would regard this more as a book for an applied mathematician who has already grasped, from other sources, what these methods can do, and wants himself to become practised in the art.

This book should suit a reader of this type very well. Successive chapters subdivide the subject according to the real mathematical distinctions, treating simultaneous linear equations, ordinary differential equations and partial differential equations of the boundary problem type (including the biharmonic case), continuing with eigenvalues, free-surface problems and integral equations. Particular attention is paid to irregular boundaries, and 43 pages of tables of finite-difference coefficients for these are given. Higher-difference methods (Fox) are briefly mentioned, but not discussed. Applications are in effect disregarded ; what is being discussed is practical computational technique.

Few other subjects are as difficult or as awkward to put into book form. Practical instruction is child's play (for both parties) by comparison. This is the more so here, where much of the art depends on skill in interpreting the behaviour of an ever-changing worksheet. This difficulty is met in the only satisfactory way, by an almost cinematographic profusion of illustrating successive stages, and a good discussion of devices (group operators, over-relaxation) which require lengthy discussion but can greatly increase the speed of the work. The work is tedious even so : but without relaxation methods many important problems admit only still more tedious solutions, or none.

The book appears to be produced by photo-lithography from copy produced on a justifying typewriter, with some letters (particularly *r*) somewhat displaced laterally. Numerals 1 and lower-case letters *l* are almost identical, giving difficulties on pp. 31 and 77, in particular. Some 8's print much too like 3's. There are copious references, but none after 1949. The price is high, but the book will be valuable for reference, and can be recommended to those lacking contact with oral and practical instruction. T. H. O'BEIRNE.

Rhodes University, Grahamstown, South Africa. Applications are invited for the post of **professor physics** from July, 1954.

The salary scale is £1400 × £50 – £1600 p.a. plus, in the case of married persons only, a variable cost-of-living allowance, at present £234 p.a. Previous experience and academic qualifications may be taken into account in fixing the commencing salary.

Full particulars and application forms may be obtained from the Secretary, Association of Universities of the British Commonwealth, 5 Gordon Square, London, W.C.1.

The closing date for the receipt of applications, in South Africa and London, is May 1, 1954.

University of New England, Armidale, New South Wales, Australia. Applications are invited for the position of **lecturer in physics.**

Commencing salary will be within the range of £A650 to £A1000 per annum according to qualifications, plus cost of living adjustment (£A252 males, £A191 females), with annual increments of £A50. The salary is subject to deductions under the State Superannuation Act.

The successful applicant will be expected to take up duties as soon as can be arranged after the date of appointment.

Further particulars and information as to the method of application may be obtained from the Secretary, Association of Universities of the British Commonwealth, 5 Gordon Square, London, W.C.1.

The closing date for the receipt of applications in Australia and London, is May 10, 1954.

Commonwealth of Australia. Appointment No. 370/81 of **Physicist** or **Metallurgist.** The Division of Tribophysics of the Commonwealth Scientific and Industrial Research Organization, located at the University of Melbourne, invites applications from physicists and metallurgists to work with its metal physics group. This group is concerned with problems of plastic deformation and phase transformation. The appointment will be made for a fixed period of three years but it may be extended for a further fixed period.

Ph.D. with additional research experience or equivalent qualifications are essential. The appointment will be made in the classification of either Research Officer or Senior Research Officer (£A656 – £A1274 p.a. nominal), plus cost-of-living adjustment which at present is £A198 p.a. with a commencing salary of not less than £A860 p.a. according to qualifications and experience. First class sea fares for the successful appointee, his wife and family, will be paid and also return fares in cases where the appointee does not take up a permanent position in C.S.I.R.O. at the expiry of his fixed period. The appointee will not be eligible for Superannuation but, if a contributor to F.S.S.U., may continue his contributions.

Applications, referring to Appointment No. 370/81, and stating full name, place and date of birth, nationality, marital state, present employment, particulars of qualifications and experience and of war service, if any, accompanied by names and addresses of at least two persons willing to act as referees, if so required, and copies of not more than four testimonials should reach the Australian Scientific Liaison Office, Africa House, Kingsway, London, W.C.2, by May 1, 1954. The Chief of the Division of Tribophysics (Dr. W. Boas) will be in England during May and will be available to meet interested candidates. He may be contacted at the above address.

A graduate **physicist** of honours standard is required for work in the research laboratories of a chemical manufacturing organization in **South Eastern England.** The successful applicant would be required to undertake work on the physical basis of problems arising during manufacture and on the properties of inorganic pigments. The position offers excellent scope and prospects. A pension scheme is operated. Salary will depend on qualifications and experience but will normally be in the range of £550 – £850 per annum. Write Box A.V.58, The Institute of Physics, 47 Belgrave Square, London, S.W.1.

Lace Research Association requires **Physicist** as deputy to Head of Physics Department. Applicants should have honours degree in physics and preferably industrial research experience. Work entails investigation into thread tensions, lubrication, application of electronics and general physical problems of the industry.

Starting salary £500 – £550 per annum. F.S.S.U.

Applications in writing to Director of Research, Lace Research Association, Glaisdale Drive West, Bilborough, Nottingham.

Royal Military College of Science, Shrivenham, Berkshire. The Civil Service Commissioners invite applications from men for the posts of (*a*) lecturer in physics and (*b*) demonstrator in physics under the War Department. The posts are unestablished but the candidate appointed to post (*a*) will be considered for an established vacancy when one occurs ; post (*b*) is normally tenable for three years.

Candidates must have (or obtain in summer 1954) an appropriate degree (at least second class honours) or equivalent. Consideration would be given to the secondment for an agreed period of members of the Scientific Civil Service, and transfers of established lecturers from the College to the Scientific Civil Service may be arranged. Teaching work is at university level. Research is encouraged and good facilities exist. Age at least 21 and under 28 on January 1, 1954, with extension for regular Forces Service and for permanent service in the Experimental Officer class. Salaries :—post (*a*) £445 – £815 ; post (*b*) £465 – £590. In assessing starting salary for post (*a*) credit will be given for approved post-graduate experience and National Service but it will not exceed £605 at age 25 and £762 10s. at age 30.

The College is residential and accommodation would be available for successful candidates, including housing for married men at economic rents. For post (*a*) the Superannuation Acts provide for the counting of unestablished service in the event of subsequent establishment ; for post (*b*) provision made under F.S.S.U. Successful candidates to take up duty in October, 1954, or as soon as possible.

Further particulars and application forms from **Civil Service Commission, Scientific Branch, 30 Old Burlington Street, London, W.1,** quoting No. S4307/54. Application forms must be returned by April 15, 1954.

Physical chemist or **physicist** who has read chemistry required for development work in the plastics and electro deposition fields. Applicants for these posts must be qualified and have had several years industrial experience in these subjects. Apply in writing, giving full particulars of qualifications, training, experience and salary required to Personnel Department E.M.I. Ltd., Hayes, Middx.

(*Continued on page iv*)

Development Engineers or **Physicists.** There are two vacancies in a rapidly expanding department of a light Engineering firm for work on aircraft and other specialized instruments. (1) A minimum of five years industrial experience on small electro mechanical devices. Salary according to experience and qualifications; (2) Young Graduate. No previous experience necessary and would be required to commence by August. Commencing salary up to £600. Write giving full details to :—**Personnel Officer, Louis Newmark Ltd., Prefect Works, Parley Way, Croydon,** quoting advertisement reference D.1.

Institute of Cancer Research, Royal Cancer Hospital. A **physicist** is required to assist a team of chemists in the biochemical application of radio-isotope tracer techniques. The work will be carried out in a new laboratory at Chalfont St. Giles, Bucks. The post is permanent and superannuable, and salary will be according to qualifications and experience. Applications, including the names of two referees, should be sent so as to reach the Secretary and House Governor, Royal Cancer Hospital, Fulham Road, London, S.W.3, not later than April 30.

The British Iron and Steel Research Association. Physicist required to lead a small team in research on metal physics problems of interest to the steel industry. Candidates should have an honours degree in Physics, and some experience of research in metal physics. Age up to 35. Starting salary in the range £900 – £1100 per annum according to age, qualifications and experience. Post is superannuated under the F.S.S.U. Location of work, London. Written applications only quoting "Metal Physics" to the Personnel Officer, B.I.S.R.A., 11 Park Lane, London, W.1.

Applications are invited for the post of **hospital physicist** (senior grade). Routine work will cover the fields of X-ray, radium, and isotope therapy and there will be opportunities for research and development in some chosen field including supervoltage therapy. Some experience of hospital physics is essential. Salary and conditions of service according to Whitley Council Agreements. Applications giving qualifications and experience, together with the names and addresses of two referees should reach the **Secretary, Liverpool Radium Institute Management Committee, 1 Myrtle Street, Liverpool, 7,** by April 12, 1954.

British Transport Commission, Research Department (Railways). A vacancy exists at Derby for a **Scientific Officer Grade I,** salary range £778 – £850. Candidates must possess a good degree in physics and should have had a wide experience in experimental physics. A knowledge of the industrial application of radio-active isotopes would be an advantage. Superannuation and certain free travel facilities.

Applications to Director of Research (Railways), Staff Section, 222 Marylebone Road, London, N.W.1.

North-Eastern Branch

An additional meeting has been arranged by the North-Eastern Branch for May 5. Professor L. C. Burrill will speak on "Applied Physics in Naval Architecture," at 6.15 p.m. (tea 5.30 p.m.), at King's College, Newcastle-upon-Tyne. The lecture will be followed by a visit to the Naval Architecture Research Laboratories.

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